

Frequency of Catheter Induced Urinary Tract Infections Following Major Gynecological and Obstetrical Surgeries, in a Tertiary Care Centre, Pakistan

Maria Jabeen, Tahira Yasmeen, Uzma Shabab, Naila Parveen, Abeer Babar, Komal masroor

ABSTRACT

Objective: The aim of this study was to determine the frequency of catheter associated urinary tract infections in patients undergoing major gynecological & obstetrical surgeries.

Methodology: This cross-sectional study was conducted in the Department of Obstetrics & Gynecology, Liaquat National Hospital & Medical College, Karachi. Duration of this study was six months from 1st December 2018 till 31st May 2019. A total of 246 patients were included in the study. Sample collection was done using non probability consecutive sampling technique. Patients who had routine catheter insertion for duration of 1-2 days during major gynecological and obstetrical surgeries were included in this study.

Results: A total of 246 patients who met the inclusion and exclusion criteria were included in the study. Patients were divided according to the duration of post-operative catheter exposure days (1 & 2). Sixty five patients were reported to have catheter induced urinary tract infection (UTI) with an overall infection rate of 26.4%. The highest rate of urinary tract infection (47.5%) was reported in patients who had their catheters removed on post-operative day 2. Most prevalent organism causing catheter induced UTI was reported to be E coli (22.4%). Chi Square test showed statistical significant association with p value 0.001 with the duration of catheterization removal and catheter induced UTI.

Conclusion: Prolonged duration of indwelling Foley catheter in post-operative Gynecology patients was associated with an increased incidence of Urinary Tract Infection. Multiparous women are more prone to get CAUTI as compared to nulliparous women.

KEYWORDS: Catheters, Gynecological Surgery & Obstetrical Surgery, Urinary Tract Infections.

INTRODUCTION

One of the most prevalent bacterial infections, urinary tract infections (UTIs) affect approximately 150 million people annually worldwide. There are two types of urinary tract infections: simple and complicated. Females who have no anatomical or neurologic abnormalities in the urinary tract are more likely to experience simple urinary tract infections. Complicated urinary tract infections

occur either due to structural or functional abnormality.¹ Indwelling urinary catheters are the cause of up to 80% of complicated urinary tract infections in the United States. Catheter-associated urinary tract infections (CAUTIs) are the infections of the urinary tract that occur in patients whose urinary bladder have been catheterized or has had a catheterization in the previous 48 hours.²

The most prevalent nosocomial infection, catheter-associated urinary tract infections account for one million annual cases in the United States³. This is the leading cause of secondary infections in the bloodstream. Chronic indwelling catheters are used to manage 3–10 percent of long term care residents.³ The annual costs of catheter-associated urinary tract infections that could have been avoided are estimated to range from \$115 million to \$1.82 billion.³ Age, female gender, diabetes, and prolonged catheterization time are all the risk factors for catheter induced urinary tract infections.⁴ With a daily risk of 3–7%, the duration of the catheterization is the most important factor in the development of bacteriuria.⁴ A study conducted

Dr. Maira Jabeen,¹ MBBS, FCPS

Associate Professor,

Dr. Tahira Yasmeen,² MBBS, FCPS

Associate Professor,

Dr. Uzma Shabab,³ MBBS, FCPS

Associate Professor,

Dr. Naila Parveen,⁴ MBBS, MPhil

Associate Professor,

Dr. Abeer Abrar,⁵ MBBS

Internee

Dr. Komal Masroor,⁶ MBBS

Internee

¹⁻⁵ Liaquat National Hospital & Medical College, KHI, Pak

⁶ Dow University of Health Sciences, KHI, Pak

Correspondence

Dr. Naila Parveen

m naila72@yahoo.com

in United States of America reported that, long term care facilities had a mean of 3.2 urinary tract infections per 1000 catheter days.⁴ Anecdotal studies also observed in their research that incidence of catheter-associated urinary tract infections was 7.78 per 1000 catheter days in the intensive care unit (ICU), where infection rates are 3–5 times higher than in other hospital patient care areas.⁴

Overuse of antibiotics, increased lengths of stay, and higher health care costs are all linked to Catheter-associated urinary tract infections in intensive care units. Fungi and both Gram-negative and Gram-positive bacteria can cause infections of urinary tract. The most prevalent pathogen in both non-complicated and complicated urinary tract infections is uropathogenic *Escherichia coli* (UPEC), accounting for 75% and 65% of infections, respectively. *Enterococcus* spp. are the overall most common causative organisms after uropathogenic *Escherichia coli*. In complicated infections of urinary tract, common pathogens may include *Staphylococcus aureus* (3%), *Proteus mirabilis* (2%), *Pseudomonas aeruginosa* (2%), group B *Streptococcus* (2%), and *Klebsiella pneumonia* (8%). Antibiotics constitute the CAUTI's foundation. The abiotic surface of the catheter, on the other hand, is susceptible to biofilm formation and frequently resists antibiotic penetration.^{5, 6}

In addition, antibiotic treatment is known to cause collateral damage because it alters the gut and vaginal microbiota and selects for resistant bacterial strains, which may open up additional niches for resistant organisms to colonize. Pili, adhesive virulence-associated factors that aid in antibiotic evasion, may also aid in the intracellular niche colonization of bacteria.⁷

In 2013, the Centers for Disease Control and Prevention (CDC), declared that the human race is now in a "post-antibiotic era," and in 2014, the World Health Organization warned that the phenomenon of antibiotic resistance is becoming dire. Rates of antibiotic resistance are rising.⁷ As a result, strategies to prevent catheter induced urinary tract infections and treatments other than antibiotics are crucial.⁷

About 90 to 100% patients suffering from bacteriuria are those that underwent long-term catheterization. Moreover, approximately 80% nosocomial urinary tract infections are due to

urethral catheterization and only 5-10% is due to genitourinary manipulations.⁸

Once catheterized patients are maintained on closed drainage, the risk of catheter-associated urinary tract infections rises to about 20%.⁹

Bacteria are introduced into the urethra during catheter insertion either intraluminally from the catheter collection bag or the tube or through the sheath of exudates surrounding the catheter. Bacteriuria is characterized by a count of less than 10⁵ CFUs/ml. It occurs in more than 25% of patients who have been catheterized for more than 7 days. This increases both the length of time a patient spends in the hospital and the costs associated with treatment.^{10,11}

Anecdotal evidences have postulated that the frequency of urinary tract infection increases due to placement of catheter as well as its prolonged use in intensive care and postoperative patients. However, literature regarding catheter associated urinary tract infections in patients undergoing major gynecological and obstetrical surgeries in Pakistan is scarce. Therefore, the current study was planned to determine the frequency of CAUTI in our female population who underwent major gynecological and obstetrical procedures. The main rationale of the study was to reduce both the length of hospital stay and financial burden associated with such patients by minimizing their use of catheters post operatively.

The aim of this study was to investigate the frequency of catheter associated urinary tract infections in patients undergoing major gynecological & obstetrical surgeries.

MATERIALS & METHODS

This cross-sectional study was conducted in the Department of Obstetrics & Gynaecology, Liaquat National Hospital & Medical College, Karachi, Pakistan. The data collection was initiated after approval from the Research & Ethical Review Committee of Liaquat National Hospital & Medical College (Ref# 0416-2018-LNH-ERC). The duration of the study was six months from 1st December 2018 till 31st May 2019. Total sample size N= 246 was calculated using the WHO sample size calculator. (Prevalence of UTI= 80%¹; CI= 95% and margin of error =5%). Sample collection was done using non probability consecutive sampling technique. Patients who had routine catheter insertion for duration of one to two days during

major gynecological and obstetrical surgeries were included in this study. Moreover, patients were divided into two groups according to their duration of catheter removal postoperatively. Group I included subjects who had their catheter removed within 24 hours and those with their catheters removed within 24-48 hours post operatively (1-2 post-op days) were included in Group 2.

Patient's suffering from UTI prior to catheter placement, having prolonged catheterization for >2 days and those having uncontrolled diabetes were excluded from the study.

The data collection was started after taking ethical committee approval. Patients were recruited from OPD and emergency admission of Liaquat National Hospital (LNH) based on inclusion and exclusion criteria.

An informed consent was obtained from each participant. A demographic profile, complete medical history, family history, catheter induced information & symptoms screening for urinary tract infection of each subject was done on a survey based questionnaire. All participants undergoing major gynecological and obstetrical surgeries and who were asymptomatic were screened for UTI by urine culture pre-operatively. After catheter removal, all patients were again assessed for culture proven infection.

Statistical Analysis was done on SPSS Version 22. Quantitative variables (duration of catheter insertion) are presented as mean and standard deviation and qualitative variables (UTI & type of surgery) were represented as frequency and percentages. Chi-square test was applied to find the association between the duration of catheter exposure time among the two groups (Postop day1, day 2) with UTI and p-value < 0.05 was considered as statistically significant.

RESULTS

A total of 246 patients undergoing major gynecological surgeries were recruited from the department of obstetrics and gynecology who met the inclusion and exclusion criteria. Major surgeries are usually performed by a team of surgeons and require a hospital stay. Descriptive statistics for mean age was calculated as 37.9 ± 10.1 years. Among the surgeries, frequency for lower segment caesarian section was the highest i.e.; 139 (56.5%). Moreover, out of the total 246 patients, 48(19.5%), ectomy/ovicystectomy & laparotomy/ myomecto-

-my 36(14.6%) & 23(9.3%) patients reported to have total abdominal hysterectomy, subtotal hyster-

Table 1: Association of Major Gynecological and Obstetrical Surgeries with &without Catheter-Associated Urinary Tract Infection (CAUTI) (n= 246)

| Major surgeries | Yes Infection n (%) | No Infection n (%) | P value (χ^2) |
|--|------------------------|-----------------------|-------------------------|
| Lower segment caesarian section (n= 139) | 18 (27.6) | 121 (66.8) | 0.002* |
| Total abdominal hysterectomy(n= 48) | 28 (43.07) | 20 (11.04) | |
| Subtotal hysterectomy (n=36) | 13 (20) | 23 (12.7) | |
| Laparotomy/Myomectomy (n = 23) | 06 (9.2) | 17 (9.3) | |
| Total | 65 (26.42) | 181 (73.57) | |

*p value<0.05 –highly significant calculated by Chi square test

respectively. Out of 246 patients who underwent gynecological or obstetrical surgeries, a total of sixty five patients were reported to have catheter induced UTI with an overall infection rate of 26.4% (Table-1). Moreover patients undergoing total abdominal hysterectomy (TAH) were mostly reported with infections (43.07%) as compared to other major surgeries and statistically significant association was found among them with P value=0.002. (Table-1)

Table 2: Association of Parity with Catheter-Associated Urinary Tract Infections in Patients Undergoing Major Gynecological & Obstetrical Surgeries (n= 246)

| Parity | Yes Infection n(%) | No Infection n(%) | P value (χ^2) |
|-------------|-----------------------|----------------------|----------------------|
| Nulliparous | 7 (10.7) | 21(11.6) | 0.03* |
| Primipara | 11 (16.9) | 70 (30.3) | |
| Multipara | 47(72.3) | 90 (34.8) | |

*p value<0.05 –highly significant calculated by Chi square test

Frequencies and percentages for parity and associated catheter induced UTI (CAUTI) is presented in table 2. Parity showed significant association with CAUTI (P value =0.03) and highest rate of infection was reported in multiparous women (72.3%) (Table-2).

Table 3: Frequency and Percentages of Micro-Organisms Detected in Patients with Catheter-Associated Urinary Tract Infections (n= 246)

| Micro-organisms | Frequency n (%) |
|-----------------|--------------------|
| E-coli | 35 (53.8) |
| Klebsiella | 14 (21.5) |
| Enterococcus | 10 (15.3) |
| Mixed type | 6 (9.2) |

*p value<0.05 –highly significant calculated by Chi square test

The highest rate of urinary tract infection (47.5%) was reported in patients who had their catheters removed on post op day 2 as in Table 1. The microorganisms in culture reports of patients with urinary tract infections included mostly E coli, enterococcus (15.3%), Klebsiella (21.5%), and mixed type (9.2%). Most prevalent organism causing catheter induced UTI was reported to be Ecoli (53.8%) as in Table-3.

Table 4: Frequencies of Catheter-Associated Urinary Tract Infections and its Association with Duration of Postoperative Catheter Removal (n= 246)

| Duration of Postop catheter removal (days) | Number of patients (percentage) | Catheter induced UTI number | Infection Rate% | P value (χ^2) |
|--|---------------------------------|-----------------------------|-----------------|----------------------|
| Group1 (within 24 hours) | 126 (51.2%) | 08 | 6.34% | 0.001* |
| Group 2 (24-48 hours) | 120 (48.7%) | 57 | 47.5% | |
| Total | 246 | 65 | 26.4% | |

*p value<0.05 –highly significant calculated by Chi square test

Duration of catheter removal and its association with infection among group 1 and group 2 is compared in Table 4. Chi Square test showed statistical significant association of CAUTI with p value 0.001 in patients with post-op 24 – 48 hours duration of catheter and CAUTI as mentioned in Table-4

DISCUSSION

Catheter-associated urinary tract infection (CAUTI) following catheterization is a growing concern in gynecology because it is one of the most prevalent infections that arise following gynecologic surgery. These catheter induced infections of the urinary tract impose a considerable morbidity and death burden on patients.¹²

Catheter induced urinary tract infection is defined by the Centers for Disease Control and Prevention as symptomatic urinary tract infection associated with indwelling catheters that have been in place for at least two days or that have been removed within two days of the diagnosis of symptomatic infections of urinary system.¹³

This cross-sectional study included a total of 246 patients who underwent major gynecological and obstetrical surgeries and had routine catheter insertion for duration of 1-2 days post operatively. The results of our study reported that out of 246 patients, 51 of the subjects were found to be associated with catheter induced urinary tract

infections. Incidence of CAUTI was found to be 26.4%. Our findings were consistent with the study conducted by Devi et al. He reported 29.3% of urinary tract infection in women undergoing primary Caesarean section and Catheterized for 24 hours postoperatively.¹⁴ Moreover, the results of our study found highest rate of urinary tract infection (47.5%) in patients who had their catheters removed on post op day 2. These findings support earlier research by Eduardo JC et al, who also reported increased incidence of urinary tract infection in patients with prolonged duration of indwelling urinary catheters during gynecological surgeries¹⁵. Prashant Shah also found increased incidence of urinary tract infections in patients who underwent lower segment cesarean section with their catheters placed for greater than twenty four hours.

El Nashar and Enomoto et al also indicated that the largest rate of UTIs occurred on the second day of catheter use in patients who underwent major gynecological surgeries like total abdominal hysterectomy and reconstructive surgery for pelvic organ prolapse and this was in agreement with the findings of our study.^{16, 17}

In our study, the most prevalent organism causing catheter induced infections of urinary tract was Ecoli (53.8%). Our findings were consistent with the observations of a study conducted by Vishwajith et al who reported Gram negative bacilli as predominated uropathogens identified from CAUTI. In their study. The most common organisms were Escherichia Coli (34.61%), followed by Klebsiella (21.15%).¹⁸ Similar findings were reported by Nandini's research that in his bacteriological profile, found Ecoli as the major causative microorganism in catheter associated urinary tract infections in a tertiary care hospital.¹⁹ Also Kulkarni and colleagues, and Dund JV et al. in their microbiological evaluation, found Ecoli to be the major cause of urinary tract infection in indwelling catheterized patients.^{20,21}

In our study, statistically significant relationship of CAUTI was found in patients whose catheter were removed within 48 hours after the surgery i.e; on post op day 2. This was consistent with the results of the study conducted by Ardiansyah et al. He found significant association of urinary tract infection incidence with Prolonged Indwelling Foley Catheter Use in Post-operative Gynecology Patient. (24–36 hours and 36–48 hours; p=0.01).²²

Our study showed significant association of parity with CAUTI. This was in agreement with Geneth al study, who in his systematic review and metanalysis found similar results with likelihood of UTI higher among multipara women than primipara and nulliparous women.²³

Limitations: The limitations of the study are that, due to the small sample size, results may not be generalized to whole population. Study ought to be led on more extensive scale to assess robotic connection between catheter induced infections of urinary tract and duration of catheter placement in major gynecological and obstetrical postoperative patients.

CONCLUSION

Prolonged duration of indwelling Foley catheter in post-operative Gynecology patients was associated with an increased incidence of Urinary Tract Infection. Multiparous women are more prone to get CAUTI as compared to nulliparous women.

Recommendation: Future recommendations to reduce the frequency of catheter associated urinary tract infections include minimal use of indwelling catheters and their removal as soon as medically feasible. Treatment of CAUTI with antibiotics remains a big challenge. Unnecessary and prolonged use of antibiotics leads to drug resistance. Small molecules such as Piliicides can be an alternative to traditional antibiotics. More research and clinical trials will be needed to determine whether or not they are safe and effective, as well as whether or not the results can be applied to people who have indwelling catheters.

Acknowledgement: We are thankful to the Faculty of Obstetrics & Gynecology for their great support and contribution in this project.

Conflicts of Interest: None

Source of Funding: None

REFERENCES

1. Mancuso G, Midiri A, Gerace E, Marra M, Zummo S, Biondo C. Urinary Tract Infections: The Current Scenario and Future Prospects. *Pathogens*. 2023 20;12(4):623. doi: 10.3390/pathogens12040623.
2. Oli AN, Akabueze VB, Ezeudu CE, Eleje GU, Ejiofor OS, Ezebialu IU, et al. Bacteriology and Antibigram of Urinary Tract Infection Among Female Patients in a Tertiary Health Facility in South Eastern Nigeria. *Open Microbiol J*. 2017;11: 292-300. doi: 10.2174/1874285801711010292.
3. Ahmad S, Ali F, Qureshi SA, Uzma B, Shakeela Q, Sabir MS, et al. The evaluation of antibiotic susceptibility pattern and associated risk factors of UTI in tertiary care hospital of Peshawar. *Pak J Pharm Sci*. 2022;3(Special):897-903.
4. Musco S, Giammò A, Savoca F, Gemma L, Geretto P, Soligo M, et al. How to Prevent Catheter-Associated Urinary Tract Infections: A Reappraisal of Vico's Theory-Is History Repeating Itself? *J Clin Med*. 2022;11(12):3415. doi: 10.3390/jcm11123415.
5. Werneburg GT. Catheter-Associated Urinary Tract Infections: Current Challenges and Future Prospects. *Res Rep Urol*. 2022;14:109-133. doi:10.2147/RRU.S273663.
6. Morikane K, Russo PL, Lee KY, Chakravarthy M, Ling ML, Saguil E, et al. Expert commentary on the challenges and opportunities for surgical site infection prevention through implementation of evidence-based guidelines in the Asia-Pacific Region. *Anti-microb Resist Infect Control*. 2021;10(1):65. doi: 10.1186/s13713756-021-00916-9.
7. Medina-Polo J, Naber KG, Bjerklund Johansen TE. Healthcare-associated urinary tract infections in urology. *GMS Infect Dis*. 2021;9:Doc 05. doi: 10.3205/id000074.
8. Peng D, Li X, Liu P. Epidemiology of pathogens and antimicrobial resistance of catheter-associated urinary tract infections in intensive care units: a systematic review and meta-analysis. *Am J Infect Control*. 2018;46 (12):e81–e90. doi:10.1016/j.ajic.2018.07.012
9. Santos ACM, Santos-Neto JF, Trovão LO, Romano RFT, Silva RM, Gomes TAT, et al. Characterization of unconventional pathogenic *Escherichia coli* isolated from bloodstream infection: virulence beyond the opportunism. *Braz J Microbiol*. 2023;54 (1):15-28. doi: 10.1007/s42770-022-00884-1.
10. Salam MA, Al-Amin MY, Salam MT, Pawar JS, Akhter N, Rabaan AA et al. A Growing Serious Threat for Global Public Health. *Healthcare (Basel)*. 2023;11(13):1946. doi:10.3390/healthcare11131946.
11. Ventola CL. The antibiotic resistance crisis: part 1: causes and threats. *P & T*. 2015;40(4):277-283.
12. Chu CM, Arya LA. Prevention of catheter-associated urinary tract infection following gynecologic surgery: A systematic review. *EMJ Urol*. 2014;1(1):66-73. DOI/10.33590/emjuro/10313573.
13. Gould CV, Umscheid CA, Agarwal RK, Kuntz G, Pegues DA; Healthcare Infection Control Practices Advisory Committee. Guideline for prevention of catheter-associated urinary tract infections 2009. *Infect Control Hosp Epidemiol*. 2010;31(4):319-326. doi: 10.1086/651091.
14. Devi G, Shah P, Shah N, Sawant V. Post catheterization urine analysis in lower segment caesarean section patients. *Indian J Obstet Gynecol Res*. 2022; 9(2):249-253. DOI: 10.18231/ijog.2022.048.
15. Eduardo JC, Alves DS, Hinden IE, Toledano IP, Freitas SG, Mondino PJ, et al. Urinary tract infection and indwelling urinary catheters: Prospective study in gynecological surgery with antibiotic prophylaxis. *Sao Paulo Med J*. 2015;133(6):517-520. <https://doi.org/10.1590/1516-3180.2014.9071412>
16. El-Nashar SA, Singh R, Schmitt JJ, Leon DC, Arora C, Gebhart JB, et al. Urinary Tract infection after hyst erectomy for benign gynecologic conditions or pelvic reconstructive surgery. *Obstet Gynecol*. 2018;132(6):1347-1357. <https://doi.org/10.1097/aog>.
17. Enomoto LM, Hollenbeak CS, Bhayani NH, Dillon PW, Gusani NJ. Measuring surgical quality: A national clinical registry versus administrative claims data. *J Gastrointest Surg*. 2014;18(8):1416-1422. <https://doi.org/10.1016/j.jss.2013>.
18. Vishwajith, Sahkare R, Rao K A, Sangeetha S. A study on catheter associated urinary tract infections (CAUTI) and antibiotic sensitivity pattern of uropathogens causing CAUTI from a tertiary care hospital. *Indian J Microbiol Res*. 2021;8(3):196-199.

20. Nandini M, Madhusudan K. Bacteriological Profile of Catheter Associated Urinary Tract Infection and its Antimicrobial Susceptibility Pattern in a Tertiary Care Hospital. J Pharm Sci Res. 2016;8(4):204–207
21. Kulkarni SG, Talib SH, Naik M, Kale A. Profile of Urinary Tract Infection in Indwelling Catheterized Patients. IOSR J Dent Med Sci. 2014;13(4):132–138. DOI:10.9790/0853-1344132138
22. Dund JV, Ninama R, Sinha M. Antibiotic Sensitivity Pattern of Bacteria Isolated from Catheter Associated Urinary Tract Infections in Tertiary Care Hospital, Jamangar. Sch J App Med Sci. 2015;3(5C):1985–1988
23. Edy Ardiansyah, Arvitamuriany Triyanthi Lubis, Mohammad Iman Syahputra. Prolonged Indwelling Foley Catheter Use in Post-operative Gynecology Patient Associated with an Increased Incidence of Urinary Tract Infections J Med Sci. 2021; 9(T3):258-261.
24. Getaneh T, Negesse A, Dessie G, Desta M, Tigabu A. Prevalence of Urinary Tract Infection and Its Associated Factors among Pregnant Women in Ethiopia: A Systematic Review and Meta-Analysis. Biomed Res Int. 2021;2021:6551526. doi: 10.1155/2021/6551526..

| Author's Contribution | |
|--|--|
| Dr. Maria Jabeen | Study design, acquisition of data and manuscript writing. Revised and approved the articles. |
| Dr. Tahira Yasmeen | Data acquisition, manuscript writing, Reviewed and approved the manuscript. |
| Dr. Uzma Shabab | Study design, acquisition of data and manuscript writing. Revised and approved the articles. |
| Dr. Naila Parveen | Data acquisition, manuscript writing, Reviewed and approved the manuscript. |
| Dr. Abeer Babar | Study design, acquisition of data and manuscript writing. Revised and approved the articles. |
| Dr. Komal Masroor | Data acquisition, manuscript writing, Reviewed and approved the manuscript. |
| All authors are responsible for the integrity of the data and the accuracy of the data analysis. | |
| <i>*Data availability statement:</i> All the data is provided in this manuscript | |

Date of Submission: 5-1-2023
 Revised date: 25-11-2023
 Accepted date: 02-12-2023